CHAPTER 1. INTRODUCTION

ABOUT THIS REPORT

This study of King County's River Management Program was initiated during the summer of 2000, a little more than a year after the National Marine Fisheries Service (NMFS) and US Fish and Wildlife Service (USFWS) listed wild populations of Puget Sound chinook salmon, and Coastal Puget Sound populations of bull trout, as threatened species under the Federal Endangered Species Act (ESA). These listings elicited a proposal from three local County jurisdictions (Pierce, King, and Snohomish Counties) to urgently develop an "ESA 4(d) Model Rule," designed to protect these listed salmonid populations and their respective habitats from any further harm.

As part of this conservation effort, several King County programs—Road Maintenance, Stormwater Management, Land Management, Water Resource Inventory Areas (WRIA) Based Planning—were completely dissected, evaluated, and re-assembled as "Model 4(d) planks"—with more protective environmental guidelines and fully responsive Monitoring and Adaptive Management Programs. The goal was that once the Services approved these planks, then any project that diligently followed the plank guidelines would automatically receive ESA coverage for accidental or unavoidable incidental take of the listed species during otherwise approved activities.

King County's River Management Program—responsible for maintenance of over 450 existing river levees and revetments throughout King County (mostly built in the 1960s and 1970s for "flood control")—was not included as a potential 4(d) plank, nor was it clear exactly how ESA coverage might best be obtained for this important public safety program.

Historical concepts of "flood control"—in which "channel clearing" and various hard engineering works, straightening river channels, dredging and snag removal, tree-free dikes and levees, river-bend rock revetments, one-way flap gates, and so forth, were designed to confine and speed the flow of floodwaters to the ocean—are diametrically opposed to salmonid conservation concepts. King County flood management has steadily evolved away from this historical model however, and formal County-adoption of the Flood Hazard Reduction Plan (FHRP) in 1993 put the King County River Management Program on the "cutting edge" of more conservation oriented approaches.

With the issues outlined above in mind, the County decided to prepare a programmatic level Biological Effects Analysis for the on-going River Management Program to determine its potential effects on listed salmonids and their critical habitat. Based on the results of this review the County could decide: (a) if any elements of the River Management Program might require modification to come into compliance with ESA, and (b) how forward-looking FHRP policies and maintenance activities might best be afforded ESA coverage.

In December 2000, King County contracted with Aquatic Resource Consultants of Seattle, Washington (the Consultant), Contract No. P03009P—**Biological Effects Analysis, Mitigation, and Program Recommendations for King County's River Management Program.** Phase 1-B of the Contract Scope of Work requires the Consultant to prepare a **Biological Effects Analysis** to determine the potential effects of the County's River Management Program on endangered, threatened, and candidate salmonids in accordance with the Federal Endangered Species Act (ESA)(Public Law No.93-205. 81 Stat.884, 12/28/1973, as subsequently amended; Rohlf 1989). This report is intended to meet that Phase 1-B contract scope requirement.

The target audience for this report is staff of King County, various cities, and state and federal natural resources and regulatory agencies. It is likely that readers from outside King County departments are not familiar with the policies and programs of the current River Management Program. Some may

recall less desirable actions from older programs that are no longer practiced.

While this report was in preparation, two substantial changes have occurred:

(1) The King County Executive determined that the County would not adopt or seek the Services' approval of the Tri-County Model ESA Response 4(d) Rules — including the draft "Management Zone (MZ)" regulations described herein—but instead would seek ESA coverage by incorporating all of the ***substance*** of the 4(d) MZ standards into an updated, rewritten version of King County's Sensitive Areas Ordinance (SAO). This ordinance would also meet the Washington State Growth Management Act requirement to update the County's critical areas regulations.

(2) Various WRIA Watershed Management Teams continued instituting the goals of the long-term WRIA Based Planning 4(d) model plank. They pulled together teams of elected officials, wide-ranging stake-holder interests, and technical experts to generate detailed habitat descriptions of each King County watershed, determine "factors of decline" for listed salmonid populations, and begin planning for future salmonid population/habitat conservation and recovery. As these new plans are becoming available, the level of information relevant to this contract has expanded significantly.

Research studies on salmonid ecology and the impacts of urbanization on habitat processes, as well as inventories of watershed and river-reach habitat quality have increased dramatically since the Puget Sound ESA salmonid listings (e.g., *"Habiatat Factors that contribute to the Decline of Salmonids"* reports; *"Near-Term Action Agenda for Salmon Habitat Conservation"* reports). Readers are recommended to the Tri-County Salmon Information Center web site (www.salmoninfo.org) and the King County Watershed Planning for Salmon Habitat web site (www.dnr.metrokc.gov/Wrias) to find many of these newer study reports and other on-going activities.

While the events described above have undoubtedly changed the background and context against which this report will be reviewed and judged—the Report's fundamental approach and general conclusions still remain both valid and relevant. The goal has been to summarize the key elements of King County's River Management Program; provide broad descriptions of King County's mainstem river habitats and their sensitive salmonid resources; and determine the probable impacts of the River Management Program upon those salmonid resources. This Biological Effects Analysis has been performed at the programmatic level, followings the National Marine Fisheries Service, "Matrix of Pathways and Indicators" methodology (Appendix F).

This **Biological Effects Analysis Report** contains five chapters, a listing of references cited, and several supporting appendices. Chapter contents are as follows:

Chapter 1. Introduction – Describes the origin and functions of the River Management Program (RMP), as outlined in the 1993 King County Flood Hazard Reduction Plan (FHRP). This chapter lists the distinct FHRP Program Elements that together make up the River Management Program; describes the approach proposed to obtain ESA coverage for Program activities; and identifies some key questions central to this biological effects analysis.

Chapter 2. Affected Fishes – Presents generalized life history summaries for chinook salmon, coho salmon, and bull trout stocks represented in King County rivers and describes the distribution of individual stocks among the various river systems.

Chapter 3. Management Zone Habitat Evaluation: Existing Conditions – Initially presents an overall description of each river system with notes on fish utilization. This is followed by an assessment of the existing state of environmental pathways and indicators important to the survival and recovery of ESA-listed and candidate fish species.

Chapter 4. Management Zone Habitat Evaluation: Biological Effects of Programmatic Actions – Presents a biological effects analysis, again using environmental pathways and indicators, for those elements of the Flood Hazard Reduction Plan and the River Management Program likely to affect salmonid habitat and populations of concern within King County's rivers.

Chapter 5. Key Findings – Summarizes the most important findings derived from the biological effects analysis of the River Management Program and the Program's contribution to species recovery.

It should be noted that this Biological Effects Analysis emphasizes key elements of the River Management Program, establishes river baseline conditions, and presents the biological effects analysis. Potential opportunities to mitigate the effects described, and recommendations to enhance existing Program policies and procedures, will not be addressed in this report.

The Appendices included with this report are intended for readers who may not be familiar with existing Flood Hazard Reduction Plan policies and River Management Program elements, or with the Tri-County ESA Response Program. The contents of the Appendices are as follows:

Appendix A. King County Council Ordinance 11112 (November 12, 1993). – Adopting the existing King County Flood Hazard Reduction Plan Policies and establishing the FHRP as a functional plan of the King County Comprehensive Plan.

Appendix B. King County Council Motion 9167 (November 12, 1993) – Establishing the River Management Program and financing priorities for implementing the Flood Hazard Reduction Plan.

Appendix C. River Management Program: Programmatic Elements – Detailed description of the Program Elements that comprise the current River Management Program. For each element, a summary of element goals and supporting FHRP policies is followed by examples of the types of construction and maintenance projects promoted under that element.

Appendix D. Desimone Levee Repair Drawings (January 2001) – An example of project specifications, construction drawings, and construction sequencing for a representative River Management Program levee maintenance project.

Appendix E. Tri-County Model ESA Response Program: Regulation of Near-shore and Aquatic Development – Introductory sections and glossary for the proposed Tri-County "Management Zone" 4(d) Rule submitted to the Services (NMFS, USFWS).

Appendix F. Matrix of Pathways and Indicators – NMFS summary of standard environmental pathways, and their associated field indicators, that are used to assess the relative health and functionality of aquatic habitats for ESA-listed and candidate salmonid species.

KING COUNTY RIVERS

There are six major watersheds in King County.

WATERSHED	WRIA*
1. The Skykomish/Snoqualmie (Snohomish) River	7
2. The Sammamish River/ Lake Sammamish	8
3. The Lake Washington/ Cedar River	8
4. The Green/Duwamish River	9
5. The White (Puyallup) River	10
6. Direct Puget Sound Drainages including Vashon Island	8, 9 and 10

**Washington State Water Resource Inventory Areas*

For the purposes of this biological assessment, the action area was limited to the portions of the mainstem rivers within each of the six major watersheds in King County where the King County River Management Program facilities are located. The Sammamish River/Lake Sammamish Watershed is combined with the Lake Washington/Cedar Watershed in this analysis. The direct Puget Sound Drainages (all relatively small coastal streams) are excluded from further analysis since no larger rivers, and hence no River Management Program facilities, are included among them.

All of King County's major rivers and their contibuting watersheds have experienced varying degrees of physical disturbance and development since European settlers first arrived in the region in

the early 1800s. A common pattern has been the general land use progression from the hunting and harvesting of natural resources, through forestry, to agriculture, urbanization, and finally industrial land uses. An excellent overview of the history and issues that characterize each watershed is presented in *"An Atlas of the Watersheds of King County, Washington,"* prepared as part of the Regional Needs Assessment for Surface Water Management (King County 1995). Additional overview material, a chronology of federal, state, and local activities on major King County rivers, is presented here in Table 1-1 (Cyrilla Cook, River Management Program, 2001).

DEFINING THE KING COUNTY RIVER MANAGEMENT PROGRAM

Preparation of an objective biological effects analysis for the King County River Management Program must begin by clearly defining the actual activities of the Program that either directly or indirectly affect ESA-listed or candidate salmonid populations, and their potential habitat. Defining these activities requires an understanding of the River Management Program on three different levels: (1) What are the formally adopted, over-arching **policies** upon which the Program is based? (2) What, if any, **priorities** were established to fund and implement the programs and projects in response to these policies? And, (3) What types of **projects** were implemented in the field as a result of applying these River Management Program policies and priorities?

The following subsections outline the development of the present King County Flood Hazard Reduction Plan (FHRP 1993), its geographic scope, and the subsequent establishment of FHRP priorities and project construction and maintenance standards. Appendix C provides a detailed description of each programmatic element of the FHRP. A summary of the projects implemented by the Flood Hazard Reduction Services Section since 1993 is presented in Tables 1-4 and 1-5.

KING COUNTY FLOOD HAZARD REDUCTION PLAN (1993)

King County was actively analyzing flooding problems and potential solutions along its major rivers (King County 1990) when it experienced what has come to be known as the 1990 Thanksgiving Day Flood. Flood flows, which exceeded all previous flow records on most of the County's rivers, caused more than $15 million (1990 dollars) in damage. Along with the damage and destruction, the flood also taught some valuable lessons that resulted in changes to King County's perception and management of flooding issues.

The Thanksgiving Day Flood clearly demonstrated that living in a floodplain could be dangerous, even for residents who, with a false sense of security, thought they were fully protected by a levee or bank stabilization project. It also became clear that structural flood control facilities, no matter how well designed and built, always carry a risk of major damage or failure. For the first time, the fundamental and entirely avoidable risks associated with floodplains became the focus of attention. As repair costs for flood damaged river facilities escalated, it also became clear that the present and recurring future costs of some river facility repairs were not justified by project benefits.

The insights gained from the Thanksgiving Day Flood substantially altered the direction of flood management activities in King County. Flooding problems along the six major rivers that flow through King County (and their larger east-county tributaries) were addressed in an entirely new Flood Hazard Reduction Plan (FHRP) (King County 1993). The FHRP includes: (1) policies to guide floodplain land use and flood control activities in King County; (2) program and project recommendations, including capital improvement projects, maintenance, relocation and elevation of homes, flood warning improvements, and river planning activities; (3) implementation priorities for the program and project recommendations; and (4) an analysis of major financing alternatives and issues.

Table 1-1. Chronology of Federal, State and Local Activities on Major King County Rivers

WHITE RIVER (King County 1988)

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1914	Pierce and King Counties enter into Inter-county river improvement district (ICRID) agreement	Pierce and King Counties	Joint management of White River by both counties pursuant to RCW 86.13; fees collected to "maintain and control" rivers.	Each county is responsible for maintaining ICRID facilities within their jurisdiction.
1914-1920	ICRID projects built	Pierce and King Counties	Dredging and channel work in lower White; construction of drift barrier, wood clearance, "Auburn wall" across overflow mouth of White River to prevent the White River from flowing into the Green River, and levee and bank stabilization projects. Many of these experimental structures failed during subsequent flood events.	King County. For ICRID facilities in King County, through ICRID agreement. The location of King County ICRID facilities is from the City of Pacific west to the Muckelshoot Indian Reservation.
1933-41	ICRID used federal monies to hire workers for flood control work	Pierce and King Counties, federal Works Project Administration	Failing ICRID levees rebuilt with rock riprap; built additional facilities needed to coincide with dam operations.	King County. For ICRID facilities in King County, through ICRID agreement.
1939-48	Mud Mountain Dam built on White River	US Army Corps of Engineers (USACOE) built, ICRID was local sponsor	Constructed Mud Mountain Dam to control peak flows along the Puyallup River levees.	USACOE.
1950 to present	Facility repairs on ICRID facilities	Pierce and King Counties, with federal and state funds	Facilities on White River maintained.	King County. For ICRID facilities in King County, through ICRID agreement.

GREEN RIVER (King County 2000)

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1854	First road built in King County	King County	Road built in lower valley.	King County Roads Division.
1870's-90's	Major railroad lines	Great Northern Railroad	Railroads made the valley more accessible and attractive to industry, encouraged development.	Great Northern Railroad (presently known as Burlington Northern/Santa Fe) Green River Flood Control Zone District (GRFCZD) maintains levees protecting tracks and other developed commercial and industrial properties.
1911	White River diversion	US Army Corps of Engineers built, King County was local sponsor.	White River diverted from Green River to Puyallup River.	King County through ICRID agreement.

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Table 1-1. Chronology of Federal, State and Local Activities on Major King County Rivers *(Continued)*

GREEN RIVER *(continued)*

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1916	Black and Cedar Rivers diverted from the Green/ Duwamish River into Lake Washington	US Army Corps of Engineers.	Reduced flooding in lowlands.	King County through GRFCZD facilities.
1919	Private levee construction begins	Farmers and other land owners	Levees built to protect flooding all along the Green/Duwamish River.	GRFCZD in District, King County outside District (County rebuilt most of these in the 1960's and 70's).
1954	Development plan for the lower Duwamish and Lower Green Rivers	City of Seattle, King County, Port of Seattle	Recommended construction of Howard Hanson Dam, converting 2,500 acres of farmland to industrial area, and expansion of dredging of the river and filling of estuary.	Port of Seattle, USACOE.
1962	Howard Hanson dam built on Green River	US Army Corps of Engineers built, King County and State of Washington were local sponsors	Protects lower valley by reducing flows to a regulated outflow (12,000 cfs); allowed intense development of lower Green River floodplain.	USACOE.
1960's-70's	River facilities built	King County	Many privately built facilities were rebuilt using County bond funds.	GRFCZD in District, and King County outside District, excluding Duwamish River corridor. See inventory.
1972	P-1 pump station installed on Green River	United States Department of Agriculture (USDA) Soil Conservation Service	Gives Springbrook Creek tributary a functioning Green River outlet.	GRFCZD.
1976	P-17 pump plant installed	USDA Soil Conservation Service	Drains portion of City of Tukwila.	GRFCZD.
1978	Green River Basin program started	Kent, Auburn, Renton and Tukwila join King County	Local program providing technical input and basin-wide decisions about flood control.	GRFCZD.
1990	GRZCZD activated	King County, Tukwila, Auburn, Kent and Renton	Activation of GRFCZD pursuant to RCW 86.15; King County administers program.	GRFCZD maintains facilities within those cities, according to prioritization. Individual cities may also maintain certain facilities (e.g., those associated with their road right-of-way).

Table 1-1. Chronology of Federal, State and Local Activities on Major King County Rivers *(Continued)*

CEDAR RIVER (King County 1990)

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1903	Masonry dam built	City of Seattle	Build for water supply and hydroelectric power; provides incidental flood storage.	City of Seattle (operates two other dams on Cedar; Landsburg and Cedar Lake).
1912	Cedar River rerouted from Green River into Lake Washington	US Army Corps of Engineers	Diverted away from Black River and into Lake Washington through straightened, dredged channel and stabilized banks.	City of Renton maintains facilities built by USACOE associated with channelization. USACOE recently dredged mouth in late 1990's.
1960's-70's	River facilities built	King County	Many privately built facilities were rebuilt by County using bond funds.	King County maintains facilities on inventory list.

SAMMAMISH RIVER (King County 1990)

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1912	Construction of the ship canal and locks	USACOE	Lakes Washington and Sammamish lowered, Sammamish River hydrology changed.	USACOE.
Early 1900s	Sammamish slough straightened into Sammamish River	Farmers and other landowners formed drainage district	Sammamish straightened and deepened to reclaim land for agriculture.	King County now maintains bank stabilization facilities (since 1962).
1962	Channelization of Sammamish River	US Army Corps of Engineers and King County	Reduced major flooding of floodplain by channelizing river channel, modifying tributaries, installing low weir to control outflow from Lake Sammamish.	Maintenance now responsibility of King County through 1966 agreement; overseen by USACOE.
1966	Maintenance agreement	King County and US Army Corps of Engineers	Maintenance to include: replenishment of bank riprap, removal of LWD from channel, removal of bank vegetation, and dredging of sediments in tributary outfalls.	King County still maintains. Informal request for a "regional variance" to address vegetation management requirements for consistency with current maintenance practices and ESA.

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Table 1-1. Chronology of Federal, State and Local Activities on Major King County Rivers (Continued)

SNOQUALMIE RIVER (King County 1990)

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1959	Feasibility project	US Army Corps of Engineers	Recommended construction of multi-purpose storage project on middle fork.	After much controversy and mediation, the project was abandoned.
1960	Tolt River Dam	City of Seattle	Built on the South Fork Tolt for water supply and hydroelectric power.	City of Seattle.
1960's and 70's	Flood protection facilities built in cities and unincorporated areas	King County	Revetments, levees built to protect farmland, roads, Cities of Snoqualmie, North Bend, Carnation and Duvall. Three major flapgates built: Ames Creek; Tuck Creek; and Woodinville-Duvall; some smaller gates also built.	Facilities in County inventory are currently maintained by King County, including those located in cities.

LAND USE AND REGULATIONS AFFECTING ALL RIVERS (Green River FODs and King County 1990)

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1852	King County established	King County, State of Washington	King County is officially a government.	
1926	King County Planning Commission appointed	King County	Recommendations for platting subdivisions; road planning; development of a sewer district.	Superceded.
1935	State Floodplain Management Act	Washington State	Gave state regulatory authority over all waters through issuance of permits for flood control permits.	Superceded.
1936 and 38	Passage of National Flood Control Act	Congress	Mandated a structural response to flooding problems; federal government funded up to 100 percent of structural project costs.	Superceded.
1959	River Improvement Fund established	King County, pursuant to RCW 86.12	Funds generated from countywide levy for flood control.	King County Flood Hazard Reduction Services (FHRS) Section.

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Table 1-1. Chronology of Federal, State and Local Activities on Major King County Rivers *(Continued)*

LAND USE AND REGULATIONS AFFECTING ALL RIVERS (Green River FODs and King County 1990)

Year	Action	Sponsored by	Description of Action	Who is Responsible Today?
1960	King County bond issuance for river and flood control purposes	King County	Allocated $5 million in bonds to implement flood control plan.	King County FHRS Section.
1964	Comprehensive Plan for King County Washington	King County	First comprehensive policy guidance for land development and provision of services and facilities.	Superceded by later comprehensive plans.
1964	King County Comprehensive Plan for Flood Control	King County	Countywide approach to flooding problems, emphasized structural solutions.	Superceded.
1964	King County bond issuance for river and flood control purposes	King County	Allocated $5 million in bonds to implement flood control plan. County rebuilt many privately built levees.	FHRS Section now responsible for maintaining facilities built/rebuilt with bonds.
1968	National Flood Insurance Act	United States Congress	Mandates purchase of flood insurance as condition of federal funding for acquisition or construction of buildings in the floodplain.	Federal Emergency Management Agency (FEMA).
1971	Adoption of State Shoreline Management Act	Washington State	State mandate for classification and protection of shorelines of the state.	Local jurisdictions.
1972	Adoption of State Shoreline Master Act WACs	Washington State	Any public or private action in floodways and many actions proposed in flood fringe of most rivers and streams are subject to regulations and must conform to the master program.	King County Department of Development and Environmental Services (DDES).
1973	Flood Hazard Ordinance	King County	Limits development in flood hazard areas to qualify for National Flood Insurance Program (NFIP), limits new subdivisions in floodplain.	Superceded.
1974	Disaster Relief Act	United States Congress	Establishes the process of Presidential Disaster Declarations.	FEMA.
1974	Adoption of King County Shoreline Management Program	King County	Emphasized stronger environmental standards for uses in designated shoreline areas.	DDES.

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Table 1-1. Chronology of Federal, State and Local Activities on Major King County Rivers *(Continued)*

LAND USE AND REGULATIONS AFFECTING ALL RIVERS (Green River FODs and King County 1990)

YEAR	ACTION	SPONSORED BY	DESCRIPTION OF ACTION	WHO IS RESPONSIBLE TODAY?
1974	King County Flood Disaster Mitigation Study	King County, but never formally adopted	Second comprehensive flood plan, relied more on managing use and development of county floodplains and multi-goal policy planning, less on structural solutions.	Superceded.
1975	Adoption of Surface Water Management (SWM) Program	King County	Preserves natural drainage systems, development must submit drainage plans for review; initiated basin planning.	Surface Water Design Manual developed by King County Department of Public Works (DPW); enforced by DDES.
1979	King County Sensitive Areas Ordinance (SAO)	King County	Restricts development in wetlands, floodplains, erosion hazard areas, and fish bearing waters.	DDES.
1985	King County Comprehensive Plan	King County	Adoption of land use and development policies. Emphasized non-structural approaches, low-density development in floodplains, and prohibited floodway development.	Superceded by 1994 plan; DDES.
1986	Surface Water Utility established	King County	Establishes a service charge to provide a revenue base.	King County SWM Division, Drainage Investigation Unit; DDES issues permits.
1987	Amendments to State Flood Management Act	Washington State	Repealed state's permitting authority in floodplains, limits state role to overseeing local implementation of comprehensive floodplain plans and regulations required for participation in the NFIP.	State Department of Ecology.
1989	Adoption of Surface Water Design Manual	King County	Required new development and redevelopment to incorporate stormwater management systems. Mandates 100 year floodplain be delineated for any project bordering a stream, lake, wetland, closed depression. Also describes how flood protection facilities must be analyzed when proposed development abuts Class 1 or 2 stream.	DDES and King County Department of Natural Resources and Parks; revised in 1998.

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Table 1-1. Chronology of Federal, State and Local Activities on Major King County Rivers (Continued)

LAND USE AND REGULATIONS AFFECTING ALL RIVERS (Green River FODs and King County 1990)

YEAR	ACTION	SPONSORED BY	DESCRIPTION OF ACTION	WHO IS RESPONSIBLE TODAY?
1990	Revisions to SAO	King County	Added zero rise floodway and compensatory storage requirement, prohibited new migration hazard areas. Regulates stream buffers, in effect, protecting entire floodplains on small streams.	DDES.
1990	Washington State Growth Management Act (GMA)	Washington State	Requires cities and counties to develop a collaborative set of policies to guide development of comprehensive plans.	Local jurisdictions.
1993	Flood Hazard Reduction Plan adopted	King County	Provides comprehensive recommendations for flood hazard reduction, policy guidance, prioritized list of projects.	Regulations: DDES; all other programs, FHRS. Other County agencies' projects may impact recommended projects (i.e., Roads Services Division).
1993	Guidelines for Bank Stabilization Projects	King County	Provides technical guidance for bank stabilization projects carried out by public and private sectors.	Projects are reviewed and permitted by DDES; FHRS has no authority to enforce.
1994	King County Comprehensive Plan	King County	Adoption of land use and development policies for consistency with the GMA.	Superceded by 2000 King County Comprehensive Plan; DDED implements.
1999	Rural Drainage Program utility adopted	King County	Provides a source of revenue for addressing stormwater problems in rural areas.	King County DNRP, Water and Land Resources Division.
2000	King County Comprehensive Plan	King County	Major GMA update to the Comprehensive Plan.	King County.

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The FHRP identifies three overarching goals. These include the reduction of:

- **flood-related hazards and damages,**
- **environmental impacts of flood control measures, and**
- **the long-term costs of flood control and floodplain management activities.**

FHRP GEOGRAPHIC SCOPE

While flooding occurs along many different types of water bodies and drainage systems in King County, the FHRP deliberately focused on a specific geographic scope:

- The mainstems of the six major rivers that flow through King County—the South Fork Skykomish, Snoqualmie, Cedar, Sammamish, Green, and White.
- The large tributaries of these same six rivers located in the eastern two-thirds of King County (Figure 1-1).

The following geographic areas are *excluded* from direct management under the FHRP:

- All small streams within the King County Surface Water Management (SWM) Urban Watershed Service and Rural Drainage Program areas, which cover roughly the western two-thirds of the County (Figure 1-2). These areas are characterized as smaller stream basins experiencing problems related to urban drainage. These problems are addressed through separately funded SWM programs.
- All tributaries within Forest Production District lands located mostly in the eastern half of King County (Folio Map 1-1). These lands fall under the jurisdiction of the ESA-approved Forests and Fish Agreement for forest practice activities.
- The lower most reach of the Cedar River in the City of Renton (the Boeing Reach), and the Green/Duwamish River downstream of the SR-99 bridge.

Although the River Management Program implements FHRP policies along the major river mainstems and larger tributaries within the geographic area described above, flood-related problems within this geographic area were considered in a basinwide context. The FHRP further states that: "…the policy recommendations, and many of the program and planning recommendations are intended to apply throughout the six major river basins (King County 1993b)." It should be noted that this substantial difference in the scope of the River Management Program and the wider application of FHRP policies countywide has significant implications for this programmatic biological effects analysis. This will be discussed in further detail below.

ESTABLISHING FHRP POLICIES

The centerpiece of the FHRP is a set of 45 individual management policies that address a wide range of issues related to floodplain land use, watershed management, flood hazard reduction, and public safety. These policies were formally adopted by the King County Council, with minimal clarifying amendments, as an addendum to the King County Comprehensive Plan (Ordinance #11112, November 15, 1993). A copy of Ordinance #11112 and the approved FHRP Policies is included in Appendix A.

The following two key findings of Ordinance #11112 establish a context for implementation of the FHRP policies:

5. Controlling all flooding conditions in King County is not practical or financially feasible, therefore river management policies should be established with the intent of reducing flood-related hazards and damages, preventing new development that would be at risk to flood and erosion hazards, and reducing long-term public costs for flood control and flood plain management.

6. King County's rivers and flood plains provide not only scenic and recreation opportunities for its residents, but also habitat for fish and wildlife. River management policies are needed to direct the county to address the protection and enhancement of fisheries and environmental

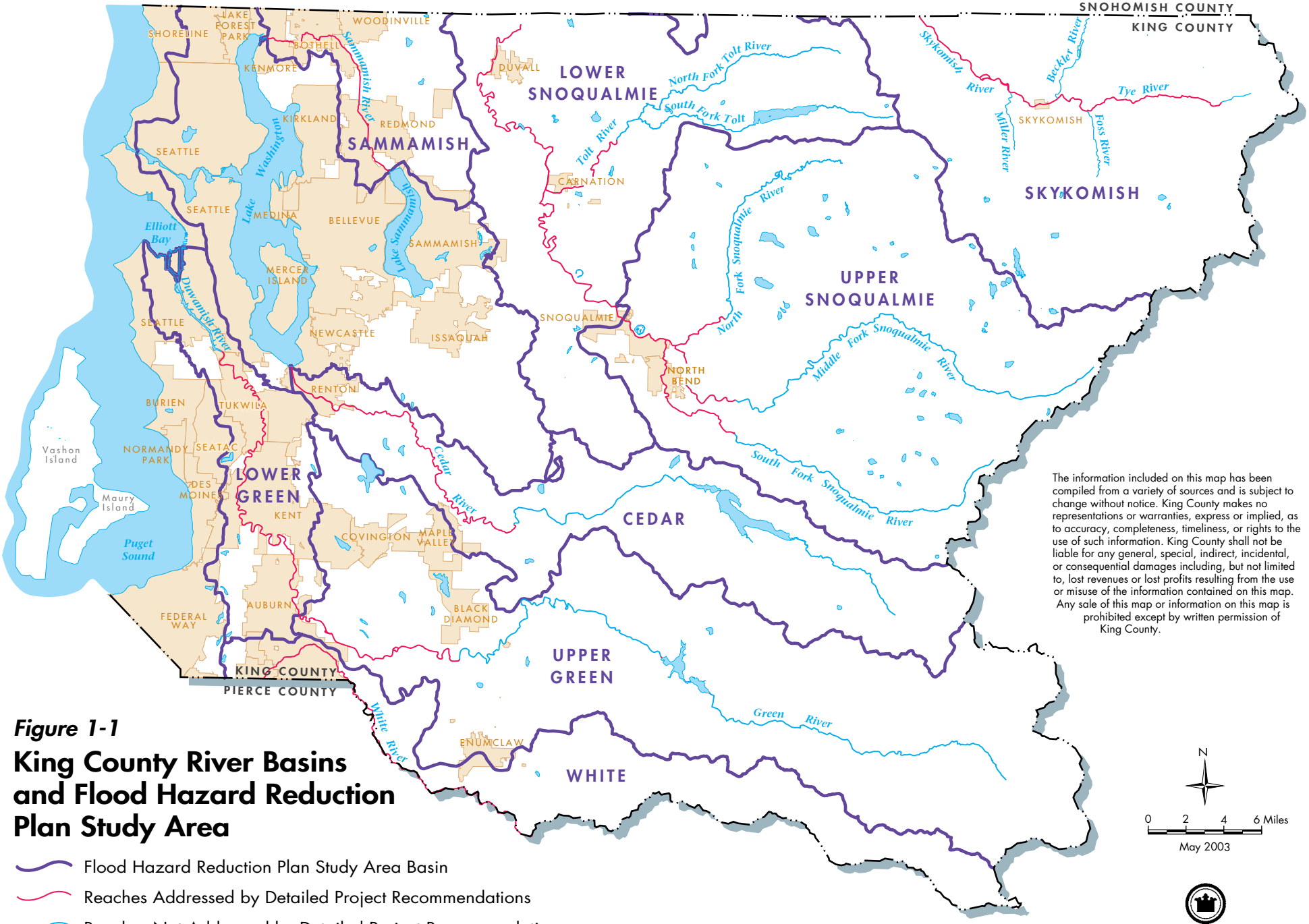

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Figure 1-1

King County River Basins and Flood Hazard Reduction Plan Study Area

- Flood Hazard Reduction Plan Study Area Basin
- Reaches Addressed by Detailed Project Recommendations
- Reaches Not Addressed by Detailed Project Recommendations
- Incorporated Area

N

0 2 4 6 Miles

May 2003

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King County
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Figure 1-2

King County Surface Water Management (SWM) Service Area Boundary

- River
- Flood Hazard Reduction Plan Study Area
- SWM Service Area Boundary
- Lake
- SWM Service Area
- Area Not Served by SWM

File Name: 0308 BEA F1-2.ai lpre

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Department of
Natural Resources and Parks

resources in concert with efforts to reduce flood damage."

Formal adoption of the FHRP policies resulted in establishment within King County Department of Public Works, Surface Water Management Division, in January 1994, of the present **River Management Program**, which is currently implemented by the Flood Hazard Reduction Services Section.

ESTABLISHING FHRP PRIORITIES

The second fundamental element of the County's new flood management program developed from Appendix B of the FHRP: Problem Sites and Project Recommendations (King County 1993). Based primarily upon observations after the Thanksgiving Day Flood, and extensive work with cities and floodplain residents following the flood, Appendix B of the FHRP presents an assessment of the problems and related project needs (on a river reach scale) for reduction of riverine flood hazards in King County. This appendix includes descriptions of 34 new or retrofit levee projects totaling 148,722 linear feet of riverbank; 65 bank stabilization projects totaling 110,500 linear feet; 15 overbank conveyance channel projects totaling 42,910 linear feet; and 33 road and bridge improvement projects; as well as several smaller related projects. Total construction costs for all the new structural capital improvement projects (CIPs) identified in Appendix B were estimated at $265 million (in 1992 dollars).

Appendix B also recommended either the purchase and removal or the elevation of numerous flood prone structures—mostly single-family houses and mobile homes—built on river floodplains. A total of 347 relocation projects and 168 elevation projects were identified. The total cost of implementing these projects was estimated to be $54 million (in 1992 dollars).

The intent of Appendix B was not to propose specific solutions for each river flooding issue, but rather to identify the potential scope and costs of implementing an entire set of solutions (Stypula 2001). The enormous costs of such solutions—over $318 Million in 1992 dollars—and the absence of any commensurate King County funding mechanism, helped define future program management priorities.

Since the adoption of the FHRP in 1993, no comprehensive funding source has been available for costly new structural CIPs. Only modest funding (i.e., River Improvement Fund levy portion of general County property tax assessment and the funds raised through the Green River Flood Control Zone District, which are used exclusively within the District) has been available for repairs, maintenance, and upgrades of River Management Program's inventory of 476 existing facilities, together with enhanced flood warning and related public outreach programs. Instead, much of the cost of repairs to flood-damaged river facilities has and will likely continue to be funded by federal and state sources, largely through public assistance and mitigation funds available following federally declared flood disasters.

The King County Council addressed program priorities in Motion #9167 (dated November 15, 1993; see Appendix B of this report). Motion #9167 notes the disparity between the FHRP's identified need for $320 million (in 1992 dollars) in CIPs, plus $3.4 million (in 1992 dollars) annually for flood plain mapping, river maintenance, and flood warning systems—while available annual funding totals only $1.5 million. The Motion goes on to stress the County's need to "…establish definitive priorities both to reduce hazards to residents and property owners from flooding and to begin timely implementation of a comprehensive river management program…" It then establishes priorities for program implementation under three categories: the River Management Program; Interagency Coordination; and Financing River Management Services. Priorities for the River Management Program, the most relevant here, were as follows:

1. Updated flood hazard mapping with current hydrology, topography, and land use information.

2. Channel migration hazard mapping and related development regulations.

3. Improvements to the County's flood warning and emergency response system.

4. Modification of the river facility maintenance program"…to include an update of project inventories and right-of-way instruments, enhanced frequency of maintenance assessments and facility repair, and changes in maintenance standards/practices to create more damage-resistant facilities."

Along with the adopted FHRP Polices, these program priorities provide the guidance under which the current King County River Management Program is managed and operated.

FHRP MAINTENANCE STANDARDS AND PRACTICE

The third fundamental initiative of the FHRP was the development and publication of creative new standards for the design, construction, and maintenance of structural capital improvement projects (CIPs) for flood reduction and flood control along the major rivers in King County. These new standards—outlined in **"Guidelines for Bank Stabilization Projects in the Riverine Environments of King County"** (Johnson and Stypula 1993)—stress bioengineering approaches to bank stabilization that have been used with great success across the United States and Europe. Since publication of this document, a number of river facility repair and maintenance projects using these methods have been successfully completed by the Flood Hazard Reduction Services Section along major rivers and streams in King County. These methods promote the protection or enhancement of fish and wildlife habitat, the reduction of long-term maintenance costs, and the minimization of impacts to flood storage and conveyance.

FHRP PROGRAMMATIC ELEMENTS

The Flood Hazard Reduction Plan policy guidance adopted by the King County Council in November 1993, includes 45 individual policies that are divided among eight categories. These include 13 general policies, eight floodplain land-use policies, four watershed management policies, 13 flood hazard reduction project policies, three river channel maintenance policies, two flood warning, information, and education policies, and two emergency response policies. To carry out these new policies, the present River Management Program was established, and eight major program components or elements were identified and funded:

1. **Structural Capital Improvement Projects –** Construction of new river levees, bank stabilization, and other structural flood control projects, where none existed before.

2. **Relocation and Elevation Projects –** The relocation, purchase and removal, and elevation of flood-prone homes in floodplain areas.

3. **Maintenance and Monitoring –** The repair and maintenance of existing flood protection facilities and monitoring of the effectiveness of structural flood control measures.

4. **River Planning –** Studies along major rivers to help in project selection and design, and land use regulation.

5. **Flood Hazard Education –** Multi-media approaches to increase public and agency awareness of King County flood hazards, regulations, and programs.

6. **Flood Warning and Emergency Response –** Flood warning systems, levee patrol, sandbag distribution, and handling of emergency repairs.

7. **Complaint Response and Enforcement –** River Management Program response to complaints, claims and lawsuits, and enforcement actions when necessary.

8. **Interlocal Coordination –** Agreements between the River Management Program and other jurisdictions in the major river basins to promote consistency, cooperation, and technical assistance in dealing with flooding issues.

Because some of the River Management Program Programmatic Elements address more than one issue (e.g., Maintenance and Monitoring), a total of 11 different elements are actually addressed. Only a sub-set of these programmatic elements directly result in implementation of field projects that potentially impact salmonid populations or habitat. It is this sub-set of elements that can result in field construction that are addressed in this Biological Evaluation of the River Management Program.

Readers are referred to Appendix C for a detailed description of each of the FHRP Programmatic Elements. For each individual Program Element, the goals and supporting FHRP policies are first outlined; examples of the types of construction and maintenance projects promoted under that element are then identified.

RIVER MANAGEMENT PROGRAM IMPLEMENTATION

The final element of the FHRP and River Management Program—**Annual Maintenance Project Planning and Prioritization**—has largely been developed through direct field project and program management experience since 1993. River Management Program personal, primarily River Basin lead staff who are familiar with river facilities, flood hazard reduction concerns, and land use activities within each river basin, keep informal, prioritized list of potential facility maintenance needs considered most desirable for their individual river basins. They meet as a group early each year, to discuss and prioritize the most critical and beneficial Program projects to be implemented during the following fiscal year. This establishes the Program's countywide project planning, permitting, and budget priorities.

Maintaining a flexible and responsive program management style is critical. Only a limited number of suitably skilled, appropriately trained and experienced King County field crews are available at any one time to implement complex in-channel river construction and habitat restoration projects. Further, damages to facilities from winter flooding may require sudden and substantial changes among project priorities.

RIVER MANAGEMENT PROGRAM PROJECTS IMPLEMENTED SINCE 1993

No new capital improvement projects (i.e., new levees and revetments) have been constructed by the River Management Program on King County rivers since 1993.

The Flood Hazard Reduction Services staff have maintained an inventory of all "Major Maintenance Projects"—mostly major repairs and fish-friendly retrofits of previously installed revetments and flood management levees—completed since 1993, under the newly instituted River Management Program. More recently they have also begun tracking the Programs' "Routine Maintenance Projects"—levee slope mowing, access control and maintenance, vegetation management, and related smaller-scale activities (detailed descriptions of these project categories are included in Appendix C).

Summary statistics on Flood Hazard Reduction Services' project implementation since 1993 are presented in several accompanying data tables. Table 1-2, lists an inventory of the types, numbers, and total length of all flood control facilities presently maintained through the King County River Management Program. Table 1-3, presents a summary of all potential (but not constructed) flood control facilities identified in Appendix B of the 1993 FHRP.
Table 1-4, lists the total number of major maintenance projects completed under the River Management Program, their total linear feet, and numbers of logs (LWD) installed, by year, from 1994 through 2002. Table 1-5, breaks out the same river maintenance project data as Table 1-4, but by individual river system. Table 1-6 summarizes the available data on recent River Management Program routine maintenance activities. Together, these data offer some perspective of the total number of River Management Program flood facilities and the annual scale of project maintenance activities.

Table 1-2.
Flood Reduction Facilities Maintained by King County River Management Program - May 2003

Basin/River (miles)	*Number of Facilities*	*Length of Facilities*
Cedar	65	9.9
Green	137	36
Skykomish	7	0.97
Snoqualmie	231	45.7
White	18	6.8
Issaquah	41	1.7
Sammamish	1	13.8
Total	**500**	**114.87**

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Table 1-3. King County Flood Hazard Reduction Plan–Basin Summary Quantity Tabs

River Basin	Residential Relocation and Elevation			Structural Flood Control											Total Estimated Project Cost (Millions)
	House Elevation (each)	House Relocation (each)	Mobile Home Relocation (each)	New Levee Const. (feet)	Improve Existing Levee (feet)	Biotechnical Bank Restoration (feet)	Rock Revetment (feet)	Overbank Conv. Channels (feet)	Flood Gate (each)	Pump Plant (each)	Gated Culvert (each)	Road Reconst. (feet)	Road Reloc. (feet)	Additional Lump Sum Estimate	
Skykomish	29	51	7	0	800	1,400	1,500	3,500	0	0	2	6,000	2,400	1,275,000	**$19.7**
Lower Snoqualmie	5	26	4	4,400	11,400	15,150	1,300	200	0	0	6	21,800	24,700	1,890,000	**$35.3**
Upper Snoqualmie	90	66	30	1,100	5,500	3,850	0	2,310	1	0	5	6,000	1,400	———	**$39.8**
Sammamish	0	0	0	0	0	16,100	0	2,800	0	0	0	0	0	430,000	**$14.5**
Cedar	39	87	72	10,700	100	25,500	0	13,300	0	0	0	0	0	0	**$67.8**
Lower Green	0	1	0	14,000	88,922	19,400	6,000	20,000	1	1	0	10,000	38,600	900,000	**$112.9**
Upper Green	0	0	0	11,000	800	6,300	800	800	0	0	4	0	2,400	18,000	**$18.4**
White	5	3	0	0	0	13,200	0	0	0	0	0	2,400	0	720,000	**$10.0**
Total Units	**168**	**234**	**113**	**41,200**	**107,522**	**100,900**	**9,600**	**42,910**	**2**	**1**	**17**	**46,200**	**69,500**		**Total**
Cost/Millions	**$4.0**	**$42.1**	**$7.3**	**$45.3**	**$50.5**	**$63.6**	**$4.0**	**$60.1**	**$2.2**	**$1.8**	**$0.1**	**$6.0**	**$13.9**	**$17.4**	**$318.4**
Sub-Totals	**Rel/El = $53.5 Million**			**Structural Flood Control: $264.9 Million**											**Million**

Table 1-4. Major Maintenance Totals, 1994–2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002	Totals
Projects	2	2	17	25	27	7	3	2	2	**87**
Linear Feet	825	1,500	8,705	3,990	8,445	1,910	5,845	100	1,920	**33,240**
Logs Installed	14	30	442	167	356	0	489	0	87	**1585**

Table 1-5. Major Maintenance Projects, by River, 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002	Totals
Skykomish										
# of Projects					5					**5**
Linear Feet					1,125					**1,125**
Logs					76					**76**
Snoqualmie										
# of Projects		1	3	11	9	1	1			**26**
Linear Feet		600	630	2,050	2,000	110	1,170			**6,560**
Logs		30	40	76	45	0	489			**680**
Sammamish										
# of Projects			1	1					1	**3**
Linear Feet			3,000	50					50	**3,100**
Logs			73	0					0	**73**
Cedar										
# of Projects			4	8	8		1			**21**
Linear Feet			700	1,140	1,720		675			**4,235**
Logs			56	32	96		0			**184**
Green										
# of Projects	2	1	9	4	5	6	1	1	2	**31**
Linear Feet	825	900	4,375	525	3,600	1,800	4,000	50	1,920	**17,995**
Logs	14	0	273	46	139	0	0	0	87	**559**
White										
# of Projects				1						**1**
Linear Feet				225						**225**
Logs				13						**13**
Totals										
# of Projects	2	2	17	25	27	7	3	1	3	**87**
Linear Feet	825	1,500	8,705	3,990	8,445	1910	5,845	50	1,970	**33,240**
Logs	14	30	442	167	356	0	489	0	87	**1,585**

Table 1-6. Routine Maintenance Tasks - King County River Management Program, 1996-2002

Year	Gate Repairs		Mowing		Noxious Weeds		Fence Repairs		Access Road Maintenance		Miscellaneous Maintenance *	
	Instances	Amount	Instances	Amount	Instances	Amount	Instances	Amount	Instances	Amount	Instances	Amount
1996			1	6,000 SY							2	30 HRS
1997	1	1 EA	2	50,000 SY			2	100 LF	2	1,100 LF	6	92 HRS
1998	1	1 EA	6	125,870 SY	1	2,000 SY			1	800 LF	5	128 HRS
1999	1	7 EA	6	117,616 SY	1	4,444 SY					15	298 HRS
2000	1	4 EA	8	218,084 SY	2	3,711 SY					1	32 HRS
2001	6	7 EA	9	303,914 SY	3	1,411 SY					4	42 HRS
2002	1	1 EA	3	29,000 SY	2	817 SY	1	15 LF	2	1,050 LF	3	17 HRS

* Miscellaneous Maintenance includes the following types of activities:

- Sign repairs/replacement
- Debris removal
- Tree removal
- Smolt counters
- LWD positioning
- Watering
- Culvert repairs
- Catch basin cleanouts
- Other

OBTAINING ESA COVERAGE FOR THE RIVER MANAGEMENT PROGRAM

In 2000 the King County River Management Program decided to seek Endangered Species Act (ESA) coverage for its flood hazard reduction activities under the County's proposed Management Zone 4(d) Rule. (See Appendix E, Tri-County Model ESA Response Program: Regulation of Near-shore and Aquatic Development.) This rule uses an in-house regulatory process administered by King County Department of Development and Environmental Services (DDES). The proposed Management Zone model provides that within a specified corridor on each side of the river or stream (generally 200 ft on the major rivers in the King County River Management Program action area) development activities will be restricted such that the habitat needs of salmonids will be met.

Under the proposed Management Zone model, an agency such as the King County Flood Hazard Reduction Services Section could choose one or any combination of three regulation options:

(1) Fixed Regulation Option. Proposals must comply with a standard set of development regulations. Certain activities are exempted under this option. For example, maintenance of existing flood control and permanent bank stabilization and erosion hazard control facilities provided that the work 1) uses "fish friendly" methods; 2) does not raise the height of or extend the linear length of the flood control facility; or 3) expand the footprint of the facility either waterward or landward into off-channel fish habitat. Emergency repairs to such facilities are also exempted if an emergency can truly be shown to exist. No new permanent facilities would be allowed under this option. Also, for exempted activities, a habitat evaluation must be prepared to identify what habitat functions will be affected and what mitigation measures will be required.

(2) Site Specific Habitat Evaluation Option. Proposals are reviewed on a case by case basis, and a habitat evaluation prepared for each.

(3) Programmatic Regulations Option. An agency can conduct a habitat evaluation on a specific geographic area or specific type or category of activity. This could include any one or all of the rivers within the King County River Management Program area, or the maintenance program for flood and erosion hazard facilities. Another example of this might be the batched biological assessment written for lower Green River levee and revetment repairs for the years 2001-2003 (King County 2001).

Each of these options requires a Habitat Evaluation, the contents of which are described in detail in the model Management Zone response (Appendix E).

In 2001 King County decided to not seek Endangered Species Act (ESA) coverage under the proposed Management Zone 4(d) Rule. Instead, many of the Management Zone substantive protection measures would be incorporated into an ordinance amending King County's Sensitive Areas Ordinance (SAO) for compliance with the Washington State Growth Management Act.

ANALYTICAL APPROACH

The National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) biological assessment guidelines specify the use of a *"Matrix of Pathways and Indicators"* (see Appendix F). This matrix was designed to summarize important environmental parameters affecting ESA-listed, proposed, and candidate salmonids (i.e., pathways) and the level of condition for each of these parameters (i.e., indicators) within the action area (NMFS 1996). Because these guidelines were originally developed for moderate gradient streams in forested watersheds where logging is the principal land use, their application (particularly some of the indicators cited) to lowland reaches of King County rivers must be tempered with professional judgment.

Use of the matrix provides valuable insights into localized and river-reach-scale effects of a specific project, or a group of generically similar projects. It is harder, however, to address basin-wide or watershed-scale effects. One of the most important of these broader-scale effects is the cumulative impact

of many small projects. While each of these may have only minor effects when considered alone, the combined effect may produce a substantial biological impact.

The construction of levees and revetments on King County rivers has altered natural river processes and functions, and undoubtedly diminished both the quantity and quality of available salmonid habitat. Indeed the traditional concept of "flood management" restricts natural river processes that are responsible for the creation and maintenance of critical salmonid spawning and rearing habitats.

Several questions critical to this biological effects analysis emerged during the review of the origins of the King County FHRP, its adopted policies, and their implementation through the current River Management Program. Because the analysis can be approached from several different perspectives, answers to these questions will help determine the most appropriate approach.

The complete King County FHRP is embodied in the Policies formally adopted under Ordinance #11112. Because of funding limitations, only a smaller subset of these Policies has been implemented by the River Management Program since adoption of the FHRP in 1993. This reduced program scope—facility maintenance and retrofits, but no new CIPs—was established by the priorities identified under Motion #9167. The available funding has also limited the number of facility maintenance projects that can be completed each year. Therefore this biological effects analysis covers only the routine maintenance and repair projects completed since 1993.

The critical difference lies in whether any *new CIPs* (i.e., levees and revetments) will be built along stretches of riverbank where no such structures presently exist. Adding new CIPs will alter river functions and processes and is likely to result in a more serious effects determination under ESA regulations. By definition, the existing Flood Hazard Reduction Services "maintenance program" does not install new CIPs. Instead, it generally enhances existing habitat, and is likely to result in a more positive effects determination under ESA regulations.

The River Management Program can only be held accountable for flood management facilities over which it has direct control. Other entities—both public and private, historic and more recent—have also built and maintained erosion and flood control facilities along King County's rivers. King County is continuing to assess the impact of erosion and flood control facilities built by others through the Water Inventory Resource Area (WRIA) planning process and United States Corps of Engineers Section 7 Consultations.